PATENT
Attorney Docket No. 18950-71

CERTIFICATE OF TRANSMISSION/MAILING

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Jessica Brown
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Serial No. To Be Assigned
Filed: Herewith
Title: APPARATUS AND METHOD FOR CARRYING OUT ANALYSIS OF SAMPLES USING RADIATION DETECTOR SPLIT BEAM RADIATION INSPECTION
Applicant: Gordon
Group Art Unit No. Unknown
Examiner: Unknown

Serial No. of Parent: 09/643,030
Filed: August 21, 2000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner of Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Please amend the above-identified application as follows prior to examination thereof:

In the Title

Please change the title of this divisional application as follows:

Apparatus and Method for Carrying Out Analysis of Samples Using Radiation Detector Split Beam Radiation Inspection.

In the Specification

Please amend the specification as follows:

Page 15 please amend the paragraph at line 24 which continues through line 10 on page 16 to amend "2a" to read -- 20a -- in the fifth line thereof as follows:

The optical system of Figure 3 comprises a light source 19, which may be for example a semi-conductor laser or a light emitting diode, arranged beneath the disc. The output beam 20 of

the light source is directed to an optical axis 20a to a polarising prism (a beam splitter) 21 which allows only light of a given polarisation to pass, i.e. only the light received directly from the laser. The transmitted light is then incident upon a first lens 22 which is arranged to focus light onto the lower surface 23 of the reflective layer within the disc. A fraction of the light incident upon the compact disc is transmitted through the reflective layer and exits from the upper surface of the disc. Any material attached to the upper surface will interfere with light exiting the disc.

Please amend the paragraph commencing at line 12 on page 17 which continues to line 2 on line 2 on page 18 to change "Figure 2" to -- Figure 3 -- in line 1 as follows:

Although not shown in Figure 3 the optical block situated below the disc also incorporates tracking optics which enables the correct tracking of the disc tracks in a similar way to that used in conventional compact disc players. The tracking optics comprise a diffraction grating, located in this embodiment at plane 37 in Fig. 3, which splits the output from the laser into three parallel beams which are subsequently focused by the first lens to provide three slightly spaced-apart spots. The spacing between these spots is such that when the central spot is directly over the centre of one track the other two spots lie on either side of that track. The detector D1 actually comprises three adjacent detectors which receive reflected light and the spacing of which is equivalent to that between the beam spots. In order to align the laser correctly, the laser position is adjusted until the output from the centre detector is maximum and the outputs from the two side detectors is a minimum. A feedback control system is used to maintain the correct tracking.

Please amend the paragraph beginning on page 19 at line 19 which continues to line 8 of page 20 to correct "aperture 34" to -- aperture 53 -- in the fifth line thereof and to change "D3" to -- D2 -- in lines 4 and 5 on page 20 as follows:

In order to provide more stringent measure of the variations in the intensity of light transmitted through the disc the detector D3 is provided (although this is optional) which receives light from the partially transparent mirror through the aperture 53, lens 27 and pinhole arrangement 35. This arrangement effectively reduced the area of the disc surface from which light is received by the detector D3 and also reduces the depth of focus. If the output of detector D2, or the ratio D1:D2, exceeds a predetermined threshold the output of detector D3 can be used

to increase the resolution with which the surface of the disc is viewed. The use of detectors D2 and D3 in combination prevents the likelihood of the detector D2 producing errors if the system used only detector D2. D3 may alternatively provide a second type of detector for detecting for example fluorescent light emitted by material attached to the surface of the disc.

On page 20, lines 15 to 22, please amend the paragraph to change "37" to -- 52 -- in the second line thereof as follows:

The optical inspection system has a 'U' shaped arm 36 with a light source 52 and a detector 38 attached to the upper and lower ends of the arm respectively. The source and detector are connected to a laser controller 39 and a buffer 40, the latter being arranged to transfer detected signal data to a personal computer 41 via an analogue to digital converter 42 and a data store 43.

On page 23, line 11, after "support surface", insert --(55)--; and on page, 23, line 12, after "disc", insert --(see FIG. 2)-- as follows:

It is also possible to construct the disc in such a way that the support surface (55) is internal to the disc (see FIG. 2) and is not the upper surface of the disc. This may provide the advantages that the sample is not damaged by handling and that a precise volume of sample may be analysed. To enable the system to be used for running gels (e.g. to identify proteins, DNA etc.), an appropriate gel may be provided on the upper surface of the disc. Electrodes for applying a potential across the gel may be formed integrally therewith or may be printed, or otherwise deposited, on the upper surface. The electrodes may be spaced radially or circumferentially. Pits may be provided in the gel into which the material to be run can be placed.

In the Claims

Please cancel Claims 2-13.

In the Drawings

Please amend the drawings as follows and as shown in redline in the attached copies of Figs. 2, 5 and 6 (sheets 1, 4 and 5) of the drawings.

In Fig. 2, the internal support surface referred to in the specification is shown diagrammatically, as seen in redline on the accompanying sheet 1 of the drawings.

Fig. 5, in the analog to digital converter indicated at 31 please change "D/A" to -- A/D -- as seen in redline on the accompanying sheet 4 of the drawings.

Fig. 6, please add reference numeral 39 to the laser controller representation in Fig. 6 as indicated in red line on the accompanying sheet 5 of the drawings.

REMARKS

The written specification and drawing changes are the same as entered in the immediate parent application Serial No. 09/643,030. The Examiner's approval thereof is requested. A Supplemental Amendment will be filed adding claims.

Please charge any additional fees or credit any overpayments to account No. 16-2230.

Respectfully submitted,

Dated: November 16, 2001

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Marked Paragraphs from the Specification to Show Changes

Page 15 please amend the paragraph at line 24 which continues through line 10 on page 16 to amend "2a" to read -- 20a -- in the fifth line thereof as follows:

The optical system of Figure 3 comprises a light source 19, which may be for example a semi-conductor laser or a light emitting diode, arranged beneath the disc. The output beam 20 of the light source is directed to an optical axis 20a [2a] to a polarising prism (a beam splitter) 21 which allows only light of a given polarisation to pass, i.e.only the light received directly from the laser. The transmitted light is then incident upon a first lens 22 which is arranged to focus light onto the lower surface 23 of the reflective layer within the disc. A fraction of the light incident upon the compact disc is transmitted through the reflective layer and exits from the upper surface of the disc. Any material attached to the upper surface will interfere with light exiting the disc.

Please amend the paragraph commencing at line 12 on page 17 which continues to line 2 on line 2 on page 18 to change "Figure 2" to -- Figure 3 -- in line 1 and to add -- , located in this embodiment at plane 37 in Fig. 3 -- at line 4 as follows:

Although not shown in Figure 3 [2] the optical block situated below the disc also incorporates tracking optics which enables the correct tracking of the disc tracks in a similar way to that used in conventional compact disc players. The tracking optics comprise a diffraction grating, located in this embodiment at plane 37 in Fig. 3, which splits the output from the laser into three parallel beams which are subsequently focused by the first lens to provide three slightly spaced-apart spots. The spacing between these spots is such that when the central spot is directly over the centre of one track the other two spots lie on either side of that track. The detector D1 actually comprises three adjacent detectors which receive reflected light and the spacing of which is equivalent to that between the beam spots. In order to align the laser correctly, the laser position is adjusted until the output from the centre detector is maximum and the outputs from the two side detectors is a minimum. A feedback control system is used to maintain the correct tracking.

Please amend the paragraph beginning on page 19 at line 19 which continues to line 8 of page 20 to correct "aperture 34" to -- aperture 53 -- in the fifth line thereof and to change "D3" to -- D2 -- in lines 4 and 5 on page 20 as follows:

In order to provide more stringent measure of the variations in the intensity of light transmitted through the disc the detector D3 is provided (although this is optional) which receives light from the partially transparent mirror through the aperture 53 [34], lens 27 and pinhole arrangement 35. This arrangement effectively reduced the area of the disc surface from which light is received by the detector D3 and also reduces the depth of focus. If the output of detector D2, or the ratio D1:D2, exceeds a predetermined threshold the output of detector D3 can be used to increase the resolution with which the surface of the disc is viewed. The use of detectors D2 and D3 in combination prevents the likelihood of the detector D2 [D3] producing errors if the system used only detector D2 [D3]. D3 may alternatively provide a second type of detector for detecting for example fluorescent light emitted by material attached to the surface of the disc.

Please amend the paragraph beginning at line 15 on page 20 which continues to line 22 on page 20 to change "37" to -- 52 -- in the second line thereof as follows:

The optical inspection system has a 'U' shaped arm 36 with a light source 52 [37] and a detector 38 attached to the upper and lower ends of the arm respectively. The source and detector are connected to a laser controller 39 and a buffer 40, the latter being arranged to transfer detected signal data to a personal computer 41 via an analogue to digital converter 42 and a data store 43.

Please amend the paragraph on page 23, lines 10-23, at line 11, after "support surface", insert --(55)--; and on page, 23, line 12, after "disc", insert --(see FIG. 2)-- as follows:

It is also possible to construct the disc in such a way that the support surface (55) is internal to the disc (see FIG. 2) and is not the upper surface of the disc. This may provide the advantages that the sample is not damaged by handling and that a precise volume of sample may be analysed. To enable the system to be used for running gels (e.g. to identify proteins, DNA etc.), an appropriate gel may be provided on the upper surface of the disc. Electrodes for applying a potential across the gel may be formed integrally therewith or may be printed, or

otherwise deposited, on the upper surface. The electrodes may be spaced radially or circumferentially. Pits may be provided in the gel into which the material to be run can be placed.

determined.

14. A substrate according to claim 13, wherein the distributed electromagnetic radiation modulating means comprises a sequence of spaced apart address codes.

15. A substrate according to any one of claims 11 to 14 and comprising a sample support surface having a three dimensional topography arranged to receive the sample.

16. A substrate according to any one of claims 11 to 14, and comprising a sample support surface on which is provided chemical or biochemical reagents arranged to interact with the sample to produce a change in the optical characteristics thereof.

AMENDED CLAIMS

[received by the international Bureau on 29 February 1996 (29.02.96); original claims 1-16 replaced by amended claims 1-13 (4 pages)]

1. A method of conducting an optical inspection of a biological, chemical, or biochemical sample, the method comprising the steps of:

supporting the sample on a substrate;

directing a beam or beams of electromagnetic radiation onto the substrate;

scanning the beam(s) over the substrate by rotating the substrate about an axis substantially perpendicular to the substrate and by moving the radiation source(s) in a direction having a component radial to said axis;

detecting radiation reflected from and/or transmitted through the substrate and sample and providing an output signal or signals corresponding to the detected radiation; and

analysing the output signal(s) to extract information on the sample being inspected,

characterised by the steps of:

simultaneously analysing the output signal(s) during the scanning step to extract therefrom, digital position address information arising from modulation of at least a part of the beam(s) by distributed electromagnetic radiation modulating means provided on the substrate, so that the scan can be aligned relative to the substrate.

2. A method according to claim 1 and comprising directing a single beam of radiation at the substrate from a single radiation source.

3. A method according to claim 2 wherein the sample is supported on a first side of the substrate and reflecting means are arranged on the second side of the substrate, the reflecting means incorporating said distributed electromagnetic radiation modulating means, the method comprising the steps of directing said beam of electromagnetic radiation onto the second side of the sample and detecting radiation reflected from the second side and additionally detecting radiation transmitted through the substrate and exiting therefrom through the first side, wherein analysis of the reflected radiation provides said address information and analysis of the second beam provides information on the sample to be inspected.

4. A method according to any one of the preceding claims, wherein the electromagnetic radiation is light having a wavelength in the spectrum between ultra-violet and infra-red.

5. Apparatus for conducting an optical inspection of a biological, chemical, or biochemical sample supported on a substrate, the apparatus comprising;

means for supporting a substrate and for rotating the substrate about an axis substantially perpendicular to the substrate;

means for providing a beam or beams of electromagnetic radiation;

drive means for moving the radiation beam(s) over the mounted sample in a direction having a component radial to

said axis so that, in combination with the means for rotating the substrate, the radiation beam(s) can be scanned over the substrate;

detector means for detecting radiation reflected from or transmitted through the substrate and sample and for providing an output signal or signals corresponding to the detected radiation wherein said output signal(s) contain information produced by modulation of the beam(s) by the sample to be inspected,

the apparatus being characterised by:

decoding means for simultaneously extracting digital address information or calibration information from said output signal(s), said information having been modulated onto the radiation beam or beams by radiation modulating means provided on the substrate, and means for using said information to align the scan with the substrate.

6. Apparatus according to claim 5 wherein the detector means is a linear array of photodetectors.

7. Apparatus according to claim 6, wherein the detector means is a linear array of photodetectors extending radially with respect to the disc.

8. A substrate for use with the apparatus of any one of claims 5 to 7 and comprising means for cooperating with the mounting means to enable the substrate to be mounted and rotated.

9. A substrate according to claim 8 for use with the apparatus of claim 5 and comprising a substantially transparent sheet having a calibration marking provided

thereon for modulating the radiation beam(s).

10. A substrate according to claim 8 for use with the apparatus of claim 5 and comprising distributed radiation modulating means for modulating at least a part of the beam(s) with digitally encoded address information so that the location on the surface of the substrate on which the beam(s) is or are incident may be determined.

11. A substrate according to claim 10, wherein the distributed electromagnetic radiation modulating means comprises a sequence of spaced apart address codes.

12. A substrate according to any one of claims 8 to 11 and comprising a sample support surface having a three dimensional topography arranged to receive the sample.

13. A substrate according to any one claims 8 to 11 and comprising a sample support surface on which is provided chemical or biochemical reagents arranged to interact with the sample to produce a change in the optical characteristics thereof.

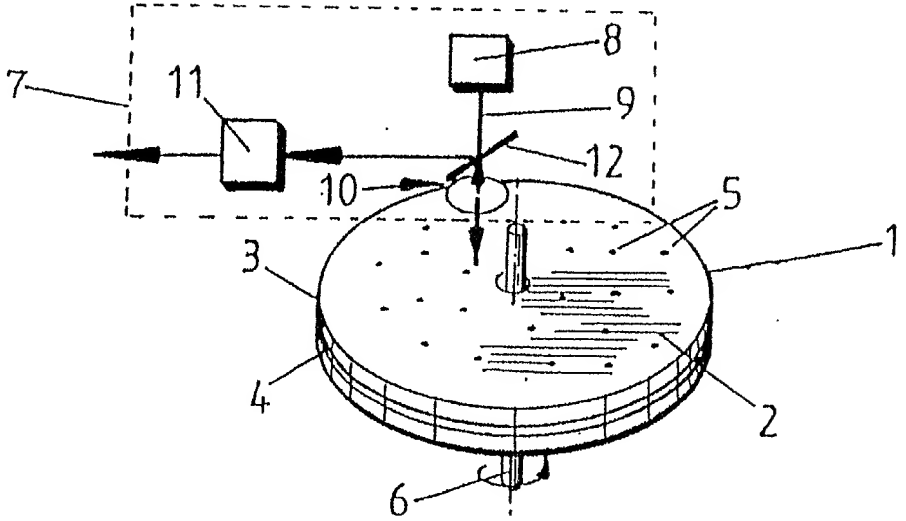

FIG.1

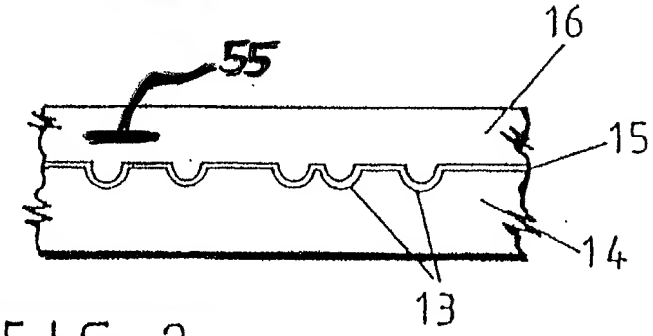

FIG.2

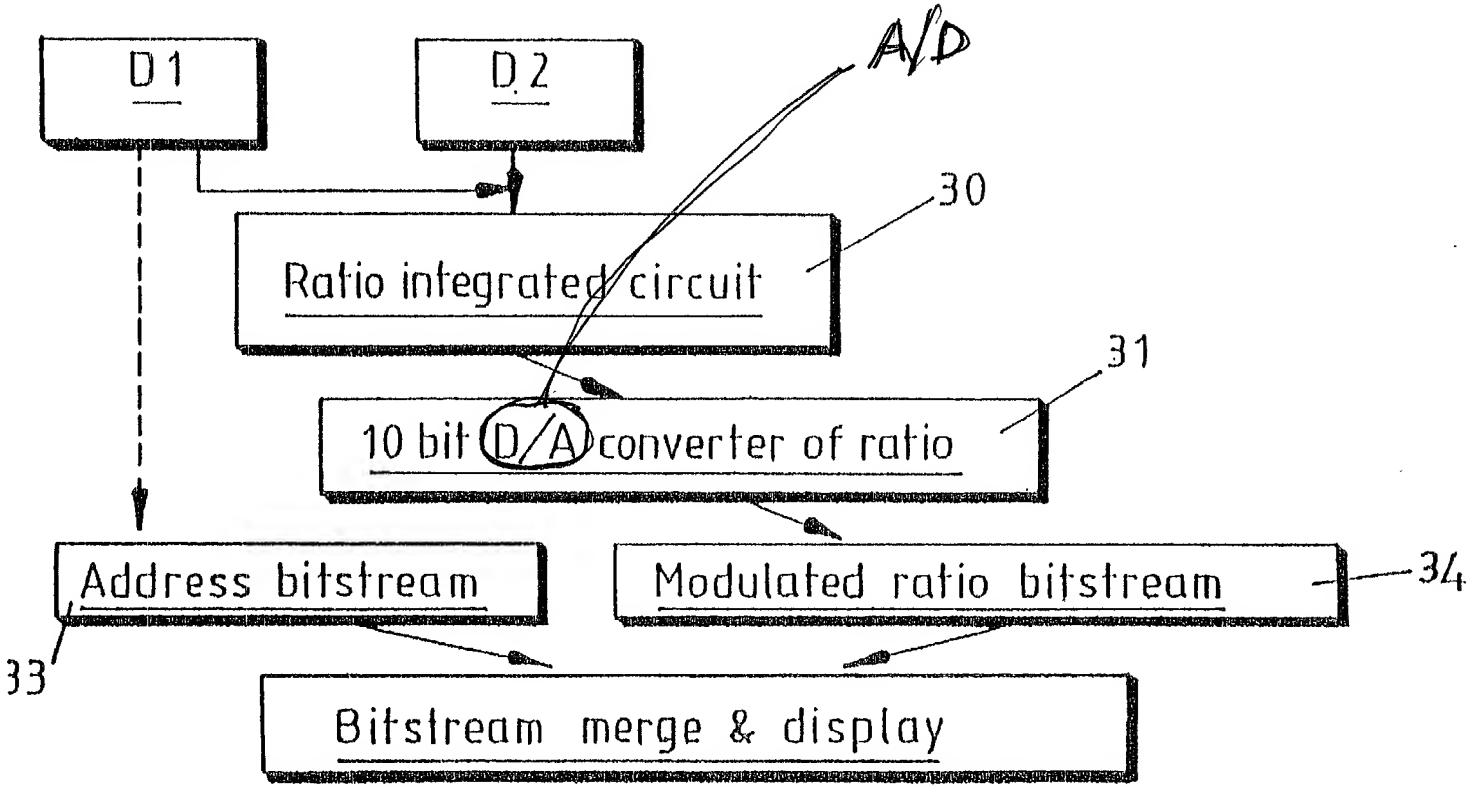

FIG. 5

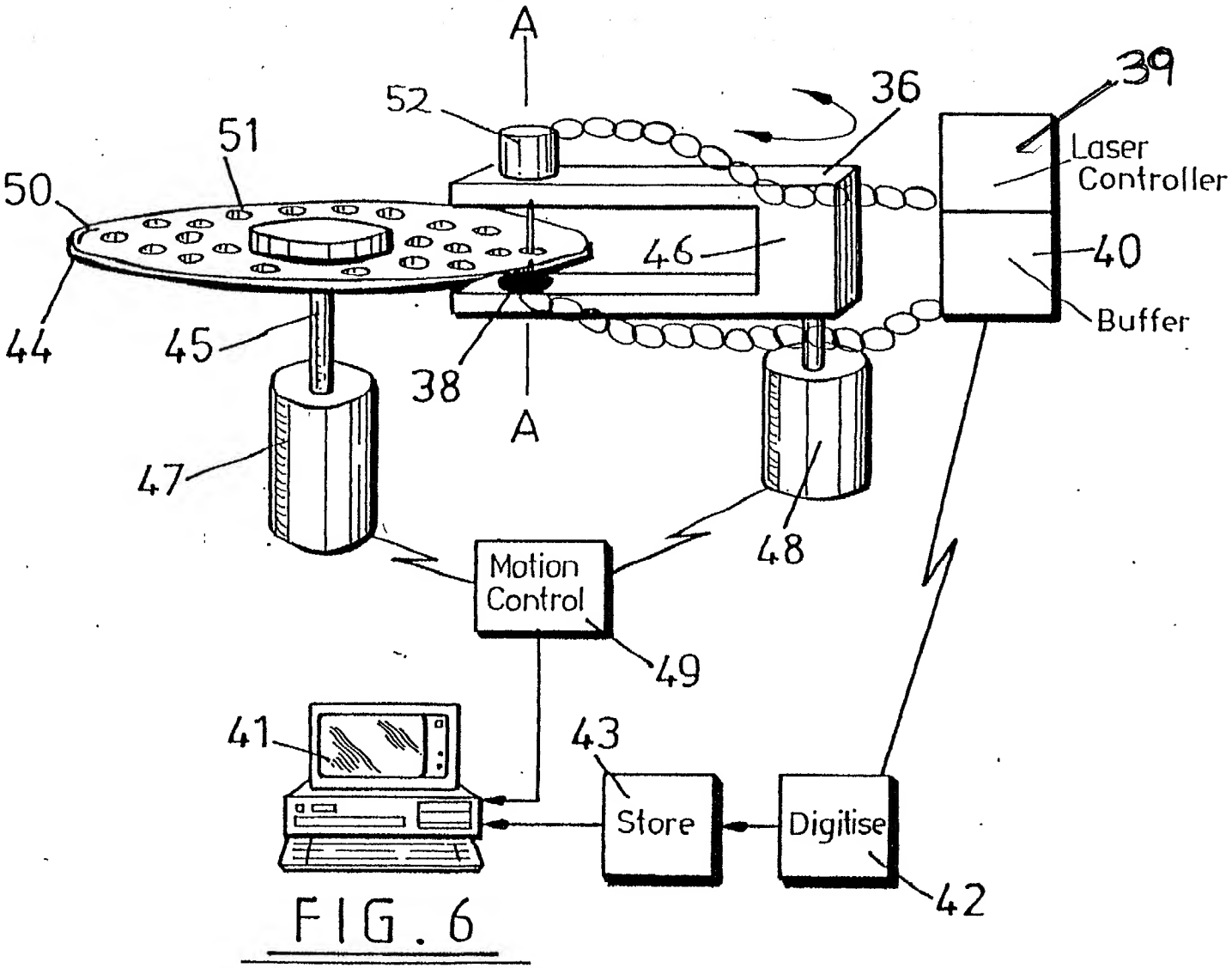

FIG. 6